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PATENT ABSTRACTS OF JAPAN

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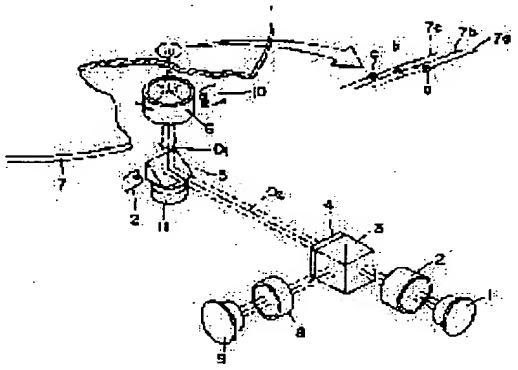
(54) MULTIBEAM OPTICAL HEAD

(57)Abstract:
PURPOSE: To obtain a multibeam optical head in which optical path length can be reduced and is equipped with a beam string rotating mechanism with superior responsiveness and high definition.
CONSTITUTION: An optical recording medium 7 is irradiated with a beam string consisting of multibeams by a multibeam semiconductor laser 1, a collimator lens 2, a polarizating beam splitter 3, a wavelength plate 4, a 45° rectangular prism 5, and an objective lens 6. In the multibeam optical head, the 45° rectangular prism 5 which reflects the multibeam and bends its optical path is placed on a rocking mechanism 11, and the 45° rectangular prism 5 is rocked around the optical axis O1 of the objective lens 6, and the beam string is rotated.



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CLAIMS

[Claim(s)]

[Claim 1] The luminescence section which consists of a collimate lens which makes parallel light the semiconductor laser which carries out outgoing radiation of two or more beams from a parallel position, and these outgoing radiation beams, A beam train rotation means to carry out minute rotation of the beam train from this collimate lens at the circumference of the optical axis of the collimate lens concerned, A condensing means to condense two or more beams on the code track of the plurality of a disk-like record medium, and to make an optical spot form, In the multi-beam light head which possesses the light-receiving section which dissociates from an outgoing radiation optical path and carries out photo electric translation of two or more reflected lights from this record medium, and can be recorded and reproduced simultaneously at two or more code tracks The 45-degree rectangular prism with which the above-mentioned beam train rotation means reflects a beam train, The multi-beam light head characterized by consisting of the rocking mechanism section which gives the rocking flexibility of the circumference of a fixed shaft to this rectangular prism, and a mechanical component which makes the above-mentioned rectangular prism rock to the circumference of the shaft of the above-mentioned regularity with a fixed control signal.

[Claim 2] The multi-beam light head characterized by the rocking mechanism section being what gives the rocking flexibility of the circumference of a fixed shaft to a 45-degree rectangular prism by the elastic deformation of the structure in a claim 1.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the multi-beam light head which performs informational record and reproduction simultaneously to two or more code tracks of an optical information record medium.
[0002]
[Description of the Prior Art] The optical recording method which condenses a laser beam to near the diffraction limitation to an optical information record medium, and performs record and reproduction is various from having the advantages, like that high-density record is possible and there is medium commutativity, and utilization is advanced. However, it was the recording method which essentially uses the heat by laser beam irradiation as compared with a magnetic disk unit, and since it was restricted in frequency band in order to carry out drive control of the objective lens mechanically in being restricted to a semiconductor laser output, or focal control and truck control of a condenser lens, with 1 beam light head, the information transfer rate was slow and the application field of an optical-recording method was narrowed. For this reason, aiming at the large improvement in a transfer rate, development of the multi-beam optical head which can perform record and reproduction simultaneously to two or more code tracks attracts attention (for example, "Multi-beam Magneto-optical Disk Drive for Parallel Read/Write Operation" besides R.Katayama, Proc.SPIE, 1078, 98 (1989) references).
[0003] As a conventional example of composition, the multi-beam light head indicated by JP,1-243247,A is shown in drawing 10 . In addition, the optical head of the same kind is indicated by JP,1-177510,A and JP,2-116030,A.
[0004] As shown in this drawing, the multi-beam semiconductor laser 101 which carries out outgoing radiation of two or more beams (illustration is three beams) is countered, the collimate lens 102 which makes each beam parallel light, the polarization beam slitter 103, the wavelength plate 104, the beam train rotating prism (dub prism) 105, and the 45-degree rectangular prism 106 are arranged one by one, and the objective lens 107 is arranged in the reflective direction of a rectangular prism 106 45 degrees. An objective lens 107 counters the optical recording medium 108, and condenses two or more beams on the optical recording medium 108. Moreover, in order to receive the reflected light from the optical recording medium 108, the condenser lens 109 and the light sensitive cell 110 are formed in the reflective direction of a polarization beam splitter 103. Moreover, the beam train rotation actuator 113 by which the semiconductor laser drive circuit is connected to the multi-beam semiconductor laser 101, and the beam train rotating-prism drive circuit 112 was connected to the dub prism 105 is installed, and the objective lens actuator 115 by which the objective lens actuator drive circuit 114 was connected to the objective lens 107 is installed. Furthermore, the servo signal detection system 116 is connected to the light sensitive cell 110, and the servo signal generated by this servo signal detection system 116 is fed back to the beam train rotating-prism drive circuit 112 and the objective lens actuator drive circuit 114.

[0005] Next, operation of the optical head shown in drawing 10 is explained. The light by which outgoing radiation was carried out from the three luminescence sections of the multi-beam semiconductor laser 101 becomes the three parallel flux of lights with a collimate lens 102, with an objective lens 107, it is condensed by the information recording surface of the optical recording medium 108, and the three beam spots a, b, and c are formed. These reflected lights branch by the polarization beam splitter 103 through a wavelength plate 104, and are condensed by the light sensitive cell 110 with a condenser lens 109. In order to make each beam spots a, b, and c arrange in parallel correctly on two or more necessary code tracks 107a and 107b and 107c at this time, the translational-motion control corresponding to the radial runout of code tracks 107a, 107b, and 107c and the roll control of a beam-spot train are performed. For example, the difference signal of the truck error signal of the beam spots a and c is fed back to the beam train rotating-prism drive circuit 112, and it is made to drive the beam train rotation actuator 113 at the same time it feeds back the truck error signal of the beam spot b to the objective lens actuator drive circuit 114 and carries out the advancing-side-by-side drive of the objective lens actuator 115. In addition, these servo signals are generated by the servo signal detection system 116.

[0006]

[Problem(s) to be Solved by the Invention] With a multi-beam light head which was mentioned above, since two or more luminescence sections in an about 50-100-micrometer pitch use what was arranged in the single tier as semiconductor laser of the light source section, a luminescence position is not in agreement with the optical axis of head optical system other than a central beam. Therefore, with the multi-beam light head mentioned above, since the outgoing radiation beam outside a shaft is included inevitably, the optical-axis inclination of the outgoing radiation beam outside a shaft poses a problem. If the outgoing radiation beam (it is called a circumference beam below) from the position which is not on an optical axis is collimated, it will serve as an optical path which inclined to the optical axis of head optical system. The beam-of-light main shaft position of a circumference beam shifts from the optical axis of head optical system, so that the optical path length will become long, if such an optical-axis inclination arises. If this gap becomes large, an optical eclipse will arise, the fall of the attainment quantity of light to a record medium and reduction of the return quantity of light from a record medium will be caused, and it will become the degradation factor of a signal quality. In order to prevent the bad influence of the optical-axis inclination of such a circumference beam, it is most effective to shorten the optical path length which turns up by the recording surface from the light source, and results in the light-receiving section.

[0007] However, with the conventional optical head, the part and the optical path length which are inserting the beam train rolling mechanism 105 of dub prism rotation type in the middle of an optical path are increasing about 20%, and there is a problem of being easy to produce signal degradation by the optical-axis inclination. Moreover, in the beam train rolling mechanism 105 of the dub prism rotation type of the conventional example, although an about 2kHz control band and high rotational accuracy are required for a beam train rolling mechanism, since prism mass is comparatively large, high-speed operation is difficult. Furthermore, for the structure which supports the prism circumference by the ball bearing etc., a mechanism size is large-sized and the problem of degrading mechanism precision also has unstable factors, such as friction torque.

[0008] In view of such a situation, the optical path length can do this invention short, and it aims at offering the multi-beam light head equipped with the highly precise beam train rolling mechanism excellent in responsibility.

[0009]

[Means for Solving the Problem] The multi-beam light head concerning this invention which attains the aforementioned purpose The luminescence section which consists of a collimate

lens which makes parallel light the semiconductor laser which carries out outgoing radiation of two or more beams from a parallel position, and these outgoing radiation beams, A beam train rotation means to carry out minute rotation of the beam train from this collimate lens at the circumference of the optical axis of the collimate lens concerned, A condensing means to condense two or more beams on the code track of the plurality of a disk-like record medium, and to make an optical spot form, In the multi-beam light head which possesses the light-receiving section which dissociates from an outgoing radiation optical path and carries out photo electric translation of two or more reflected lights from this record medium, and can be recorded and reproduced simultaneously at two or more code tracks The above-mentioned beam train rotation means is characterized by consisting of a 45-degree rectangular prism which reflects a beam train, the rocking mechanism section which gives the rocking flexibility of the circumference of a fixed shaft to this rectangular prism, and a mechanical component which makes the above-mentioned rectangular prism rock to the circumference of the shaft of the above-mentioned regularity with a fixed control signal.

[0010]

[Function] Have supported the 45-degree rectangular prism which reflects in a disk-like record medium the beam train which is abbreviation parallel, and which consist of a beam, and is changed into a light perpendicular to the disk concerned in the rocking mechanism section, and make it rock by the rectangular prism and the mechanical component the 45 degrees concerned, it is made to incline slightly to the tangential direction of a disk, and each beam is positioned at a different code track.

[0011]

[Example] Hereafter, this invention is explained based on an example.

[0012] The multi-beam light head concerning one example is notionally shown in drawing 1 . in addition, the composition illustrated with the actual optical head -- in addition, although two or more light sensitive cells for dividing the following error of the plastic surgery prism for making the outgoing radiation shape of beam circular or an objective lens with an information signal, and usually detecting it are used, since it is not involved in the essence of those well-known with ******, and this invention, it has omitted

[0013] As shown in drawing 1 , the multi-beam semiconductor laser 1 which carries out outgoing radiation of two or more beams is countered, and the collimate lens 2 which makes each beam parallel light, polarization beam SUPIRITTA 3, the wavelength plate 4, and the 45-degree rectangular prism 5 are arranged one by one, and it is arranged so that an objective lens 6 may counter the optical recording medium 7 in the reflective direction of a rectangular prism 5 45 degrees. Moreover, in order to receive the reflected light from the optical recording medium 7, in the reflective direction of a polarization beam splitter 3, the condenser lens 8 and the light sensitive cell 9 are arranged. In addition, the objective lens actuator 10 is attached to the objective lens 6.

[0014] Here, although a rectangular prism 5 is located directly under the optical recording medium 7 45 degrees and a beam parallel to the optical recording medium 7 is changed into a perpendicular beam, the rectangular prism 5 is fixed on the rocking mechanism 11 the 45 degrees concerned. The rocking mechanism 11 supports a rectangular prism 5 45 degrees free [rotation around a shaft (in this example, it is in agreement with the optical axis O1 of an objective lens 6) perpendicular to the optical recording medium 7], and the 45-degree rectangular prism 5 is fixed so that the center of the reflector and a rotational center may be in agreement. Moreover, the prism mechanical component 12 is attached to the rectangular prism 5 45 degrees, and the 45-degree rectangular prism 5 supported by the rocking mechanism 11 by this can be rotated now. In addition, optical axis O2 of a collimate lens 2 It is in agreement in the center of a reflector of a rectangular prism 5 45 degrees, and is the optical axis O1 of an objective lens 6. It is in agreement in the center of a reflector of a rectangular prism 5 45 degrees.

[0015] In the composition of drawing 1 , two or more beams which carried out outgoing radiation from the multi-beam semiconductor laser 1 penetrate a polarization beam splitter 3 and a wavelength plate 4 through a collimate lens 2, and they carry out incidence to the optical recording medium 7 45 degrees at a rectangular prism 5 at abbreviation parallel. Thus, the circumference beam which is not in agreement with an optical axis among two or more beams which constitute the beam train which carries out incidence to a rectangular prism 5 45 degrees shifts from the center of a reflector of a rectangular prism 5 45 degrees, since incidence is carried out, when the rotation drive of the rectangular prism 5 is carried out by the prism mechanical component 12 the 45 degrees concerned, a reflector will carry out rotation displacement and the incidence position to the objective lens 6 of reflected two or more beams will carry out rotation displacement a center [an optical axis]. Consequently, when the condensing spot position to the optical recording medium 7 also rotation-displacement-controls suitably this angle of rotation (angle of inclination to the truck tangential direction of a beam train) focusing on a central beam, each beams a, b, and c can be positioned on each trucks 7a, 7b, and 7c of the optical recording medium 7.
[0016] One example of a rolling mechanism is shown from a beam, referring to drawing 2 -4. As shown in this drawing, in this example, the coil 21 has pasted the tooth back of the 45-degree rectangular prism 5 pasted up on the rocking mechanism 11. On the other hand, to the head housing 22, the yoke 23 of the shape of two KO character has fixed, and perpendicular section 22a of a coil 21 is located among the arms 23a and 23b of a yoke 23. Moreover, the magnet 24 has pasted the inside of arm 23a of the outside of a yoke 23, respectively, and the magnetic circuit is formed with Arms 23a and 23b and the magnet 24 of a yoke 23. That is, the magnetic field has occurred between arm 23a of each yoke 23, and 23b, and perpendicular section 22a of a coil 21 has interlinked in these magnetic fields. Therefore, when current is passed in a coil 21 with this composition, the force according to current acts on perpendicular section 23a, and it is the optical axis O1 of an objective lens in the 45-degree rectangular prism 5. The torque rotated at the center will act.
[0017] Next, an example of the concrete composition of the rocking mechanism 11 is explained, referring to drawing 3 and drawing 4 . In addition, the like is indicated by JP,61-226229,A, JP,62-200011,A, etc. similarly [the illustrated rocking mechanism is better known than before, and].
[0018] this rocking mechanism 11 -- rotation of the shape of an upper cylinder -- a member 31 and the holddown member 32 of the bottom tubed [this] -- having -- rotation -- a member 31 and a holddown member 32 It is a member 33. the cross section which projects to the inner direction of another side mutually -- the circular buckling-of-track sections 31a and 32a -- having -- rotation -- the inside of a member 31 -- projection -- the bottom -- buckling-of-track section 32a and rotation -- the wall of a member 31 -- sheet metal -- moreover, the inside of a holddown member 32 -- projection -- the bottom -- buckling-of-track section 31a and the wall of a holddown member 32 -- sheet metal -- it is combined by the member 34 sheet metal -- a member 33 and sheet metal -- although the member 34 has shifted in the upper and lower sides -- mutual -- intersecting perpendicularly -- **** -- the so-called crossed strip -- constituting -- **** -- rotation -- a member 31 and a holddown member 32 -- sheet metal -- a member 33 -- it is accepted 34, comes out and is connected therefore, rotation -- a member 31 -- the intersection of a crossed strip, i.e., sheet metal, -- the intersection of a member 33 and a holddown member 34 is rotated as the center of rotation therefore, drawing 2 -- setting -- the center of the base of the 45-degree rectangular prism 5 -- the intersection of the aforementioned crossed strip -- doubling -- rotation -- if a member 31 is pasted, a desired rocking mechanism can be acquired
[0019] The beam train rolling mechanism concerning other examples is shown in drawing 5 -7. As shown in this drawing, at this example, the rocking mechanism section and the mechanical component consist of piezo-electric bimorphs of four sheets. this beam train rolling

mechanism -- rotation of the shape of an upper cylinder -- a member 41 and the holddown member 42 of the shape of a lower disk -- providing -- the center of a holddown member 42 -- rotation -- the fixed shaft 43 which projects in a member 41 is set up, and an end pastes the fixed shaft 43 -- having -- the other end -- rotation -- it is prepared so that the piezo-electric bimorph 44 of four sheets inserted in the slit prepared in the member 41 may shift by a unit of 90 degrees In addition, it is shown in detailed drawing 7 of the piezo-electric bimorph 44. if voltage is impressed to each piezo-electric bimorph 44 with such composition -- the point of each piezo-electric bimorph 44 -- voltage -- responding -- the same direction -- bending -- distortion -- generating -- rotation -- torque acts on a member 41 in this direction Therefore, if the rectangular prism 5 is pasted up on the rotation member 45 degrees, a rectangular prism 5 can be rocked the 45 degrees concerned.

[0020] As mentioned above, when an optical recording medium is a diameter disk of 130mm, for example, a necessary prism angle of rotation is about **0.2 degrees, and although the example of some beam train rolling mechanisms was shown, since the variation rate of the circumferencial direction of 4mm, then a rocking mechanism is about **15 micrometers about a rocking mechanism radius, the above-mentioned example can enough be used. In addition, although the structure is not limited, if elastic deformation is used for a rocking mechanism like the above-mentioned example, a small and highly precise thing is realizable, if a beam train rolling mechanism makes a rectangular prism rock 45 degrees.

[0021] The example in the case of being valid for a drive in drawing 8 and the multi-beam light head explained to 9 above, respectively is shown. In addition, the same sign as drawing 1 is given to each composition member, and the overlapping explanation is omitted.

[0022] Drawing 8 is carried in positioner moving-part 51A by making all (an objective lens 6 and objective lens actuator 10) of the optics (a collimate lens 2, a polarization beam splitter 3, and wavelength plate 4) containing the multi-beam semiconductor laser 1, a beam train rolling mechanism (the 45-degree rectangular prism 5, the rocking mechanism 11, and mechanical component 12), and a condensing system into one. On the other hand, drawing 9 is an example which is fixed, installs the optical system of multi-beam semiconductor laser 1 grade in the drive base, and carries only the condensing system and the beam train rolling mechanism in positioner moving-part 51B because of lightweight-izing of moving part. In any case, it is realizable by using the beam train rolling mechanism of the above-mentioned example by the same optical path length as the case of the usual 1 beam light head. In addition, 52 show a spindle motor among drawing.

[0023]

[Effect of the Invention] Since the beam train rolling mechanism and multi-beam light head by this invention are the structure of rotating a beam train by rocking a rectangular prism 45 degrees, they can shorten the optical path length compared with the case of the former which inserts the beam train rolling mechanism of dub prism rotation type into an optical path, and can make small optical-axis influence of physical orientation. Moreover, since a necessary rectangular-prism size is small compared with dub prism, a fast response is raised. Furthermore, if elastic deformation is used for a rocking mechanism as shown in the example, the effect that a beam train rolling mechanism will become small and highly precise will be done so.

[Translation done.]